Summer Bentgrass Decline Complex May Be More Physiological Than Pathological

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The decline of cool-season turfgrasses during stressful summer months is not a new problem. **Creeping bentgrass (*Agrostis stolonifera)* root decline begins as soil temperatures rise in early summer.** The condition accelerates in response to low mowing heights and a reduction in soil oxygen. The latter commonly occurs in greens with poor water infiltration and percolation rates during wet periods or in response to excessive irrigation and/or soil compaction. Shade and poor air and surface water drainage intensify the problem. Dr. Bingru Huang and coworkers at Kansas State University have been investigating the root loss phenomenon in field grown creeping bentgrass. Dr. Huang's findings were presented recently at the 1997 American Society of Agronomy Meetings and the 1997 Kansas Turfgrass Conference. According to her findings, there was a greater and more rapid loss of roots in field plots maintained at 1/8 inch (3.2 mm) vs. 5/32 inch (4.0 mm) mowing height. Using a clear tube rhizotron and video photography, she could detect root loss beginning as soil temperatures rise in late June or early July. Root loss actually begins close to the crown, because roots emanating from the crown are subjected to higher temperature stress than roots growing deeper in the soil profile. In greenhouse and growth chamber studies, Dr. Huang and coworkers demonstrated that root loss occurs more greatly in overwatered, undrained soils vs. well-watered, drained soils. Root mortality also was increased when plants were maintained at higher temperatures of 95°F day/77°F night (35/25°C), when compared to lower temperatures of 77/58°F (25/14°C). The mechanism of accelerated root loss in wet soils is likely due to displacement of air and therefore a depletion of oxygen. Plants grown in wet soils and a high-temperature environment exhibited leaf chlorosis, increased respiration and a reduction in photosynthesis. Most golf course superintendents will likely agree that their most troublesome greens tend to be in low-lying, pocketed or shaded sites. The soils in pocketed greens remain wetter longer and plants growing in these greens invariably are much more poorly rooted when compared to plants grown on greens in the full sun. Wet soils also retain heat longer than well-drained soils. Dr. Huang's findings have shown that root mortality is increased by excessive soil wetness, high temperature, and reducing mowing height. Hence, root decline in creeping bentgrass is clearly a response to abiotic stress factors.

The "summer bentgrass decline complex" has been described as a disease caused by interacting factors including high temperature stress, high humidity, shade, soil compaction and root pathogens. *Rhizoctonia solani* and *Pythium* species that attack roots are said to be the pathogens that interact with abiotic stresses to cause the summer bentgrass decline complex.

The pathogen connection to this theory is based only on a favorable color response and overall improvement of turf quality when stressed greens are treated in the summer with Aliette Signature® (fosetyl aluminum) fungicide tank-mixed with either Daconil® (chlorothalonil) or Fore® (mancozeb).

Research conducted at the University of Maryland does not entirely support the view that *R. solani* and root-attacking *Pythium* are major contributing factors to this malady. It is true that Aliette Signature plus either Fore, Daconil or Chipco 26019® (iprodione) effectively control brown patch, and that Aliette Signature is an excellent *Pythium*-targeted fungicide. These Aliette Signature tank-mix partners even have been shown at times to provide improved *Rhizoctonia* brown patch control, when compared to any component applied alone. What we learned from our research in Maryland, however, is that *R. solani* rarely attacks roots of even severely blighted plants and that the *Pythiums* that attack bentgrass roots are more damaging during cool and moist weather of the spring and autumn rather than during the summer months. *Pythium* spores, however, are common inhabitants of roots and their presence in high numbers can cause roots to dysfunction in the summer. In several studies conducted in Crenshaw and Penncross creeping bentgrass (*Agrostis stolonifera)* monostands mowed to a height of 3/16 inch (4.8 mm), **we demonstrated a consistent improvement in turf color and overall turfgrass quality with Aliette Signature + Fore and Aliette Signature + Daconil applications. The enhanced quality appeared in the absence of disease during periods that were either cool and moist or hot and dry.** The improvement in turf quality usually becomes apparent within a week following spraying plots, and persists for 1 to 2 weeks. We quantified the nutrients and chlorophyll levels in grass clippings collected from the fungicide- and non-fungicide-treated plots several times. While Aliette Signature sometimes was associated with

elevated phosphorus levels in tissues, Aliette Signature + Fore-treated leaves consistently contained greatly elevated manganese levels and sometimes elevated zinc, magnesium and sulfur levels. There was, however, no increase in manganese or other micronutrients in tissues from plants treated with the equally beneficial Aliette Signature + Daconil treatment. Hence, it appears that manganese and other enhanced micronutrient levels in fungicide-treated plants cannot be directly correlated with the improved color responses observed. Because color enhancement from the fungicides occurs during diverse environmental conditions in the absence of disease, it would appear that the improved quality is more physiological than chemotherapeutic. Perhaps these fungicide tank-mixes are enhancing other pigments (e.g., *anthocyanins, carotenoids*, etc.) or possibly they in some way promote more efficient rooting, photosynthesis, respiration, or other physiological processes.

The decline in bentgrass that we see in Maryland during mid-to-late summer appears to be mostly a combination of abiotic stresses including one or more of the following: high temperature, high humidity, shade, excessively wet soils; or mechanical injury from mowing too low or from grooming greens during hot weather when bentgrass is not actively growing. The research conducted at Kansas State University indicates that bentgrass roots will shorten and darken in color as soil temperatures rise in the summer. The decline in roots will naturally occur throughout the summer until root initiation and regrowth of the root system resume with the advent of cool and moist weather in the autumn.

Fast Putting Surfaces

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- has not been observed to form seedheads in over 9 years of observation.
- exhibited slightly better low-temperature hardiness than Tifdwarf and Tifgreen.
- Champion, Tifdwarf, and Tifgreen all had poor shade adaptation.

Based on these research assessments, Champion may be described as a **vertical dwarf hybrid bermudagrass in that it has a slow vertical leaf extension rate but rapid lateral stem development.** It is the first cultivar to exhibit this unique type of morphological-growth characteristics. The high shoot density, fine leaf texture, and slow vertical leaf extension rate of Champion contribute significantly to improved surface ball roll distance on putting green surfaces, with distances easily exceeding 9 feet (2.7 m) and well into the 10 foot (3.0 m) range. Champion has been successfully winter overseeded, but for best performance requires adjustments in the procedures followed.

MS Supreme was released by Mississippi State University in 1997, with significant quantities of vegetative planting material being available in 1998. Limited published comparative quantitative research data are available. It would appear to be a vertical dwarf type, with a substantially higher shoot density than Tifdwarf. It has good tolerance to a 1/8 inch (3.2 mm) mowing height.

TifEagle was released from the Georgia Coastal Plain Experiment Station in 1997, with some vegetative material available in 1998 and substantial quantities in 1999. Limited published comparative quantitative research data are available. TifEagle has improved shoot density compared to Tifdwarf, but preliminary data show it to be significantly lower in density compared to Champion, especially at a 1/8 inch (3.2 mm) cutting height.

At this time not much is known about the comparative characteristics and long-term performances among these four new dwarf bermudagrass cultivars. This is particularly true in the areas of growth-morphology, and in disease, insect, and nematode resistance and/or susceptibility. Further research is obviously needed.

Turfgrass Cultural Changes

The very high shoot density bentgrass and bermudagrass cultivars will perform best at mowing heights of 1/8 inch (3.2 mm). Less time, chemicals, and money will be spent on *Poa annua*, moss, and algae control. However, **it should be emphasized that these very-high-density cultivars will require some changes in the turfgrass cultural program to maximize their performance.** Included may be (a) up to weekly high-density, mini-tine cultivation, especially during periods of rapid shoot growth, (b) up to weekly, regular vertical cutting for biomass management, especially during periods of rapid shoot growth, and (c) a somewhat lower nitrogen fertility program.